CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET
SACRAMENTO. CA 95814-5512

July 24, 2000

Members of the Senate Energy, Utilities and Communications Committee
Members of the Senate Budget and Fiscal Review Committee
Members of the Senate Appropriations Committee
Members of the Assembly Utilities and Commerce Committee
Members of the Assembly Budget Committee
Members of the Assembly Appropriations Committee
California State Capitol Building
Sacramento, California 95814

Re: *California Energy Commission's Quarterly Report Concerning the Public Interest Energy Research Program*

Dear Members:

In accordance with Public Resources Code Section 25620.5(h), the California Energy Commission hereby transmits its Quarterly Report regarding the Public Interest Energy Research (PIER) Program for the period April 1 through June 30, 2000. The enclosed report provides the required evaluation of the progress and a status of the PIER Program's implementation for this quarter.

To date, the Energy Commission has made substantial progress in meeting the goals of the PIER Program, as demonstrated by the early results of PIER-funded projects that will help advance science and technology to improve the quality of life for California citizens. Should you have questions or comments concerning this report, please feel free to contact Tim Schmelzer, Assistant Director of Governmental Affairs, at 654-4942.

Respectfully submitted,

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ROBERT A. LAURIE
Commissioner and Presiding Member
Research, Development and
Demonstration Committee

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ARTHUR H. ROSENFELD
Commissioner and Associate Member
Research, Development and
Demonstration Committee

Enclosure

California Energy Commission's Quarterly Report Concerning the Public Interest Energy Research Program (April 1 through June 30, 2000)

In accordance with Public Resources Code (PRC) Section 25620.5(h), this document hereby constitutes the California Energy Commission's Quarterly Report for the Public Interest Energy Research (PIER) Program, covering the period from April 1 through June 30, 2000. This report provides the required "evaluation of the progress and a status of the PIER Program's implementation" for this past quarter. It also provides input for the Energy Commission's more detailed *Annual Report Concerning the Public Interest Energy Research Program* (hereafter referred to as *Annual PIER Report*) required pursuant to PRC Section 25620.8.

I. SUMMARY STATUS OF THE PIER PROGRAM

As specified in PRC Section 25620, the primary mission of the PIER Program is to "improve the quality of life of this State's citizens . . . [by funding] public interest energy research, development and demonstration [RD&D] projects that are not adequately provided for by competitive and regulated energy markets." The funds for this program, totaling approximately $61.8 million annually, come from the electricity ratepayers of specified investor-owned utilities and are held in the PIER Program Trust Fund Account.

Energy Commission decisions related to the PIER Program are initially reviewed by the Commission's Research, Development and Demonstration (RD&D) Committee. During the second quarter of 2000, Dr. Arthur H. Rosenfeld was appointed to the Energy Commission, and he brings years of energy expertise to the RD&D Committee, where he is currently serving as the Associate Member.

During the second quarter of 2000, the PIER Program accomplished the following:

- The Energy Commission managed contracts for 83 PIER projects and two specific RD&D collaborative funding efforts, which received approximately $70 million in PIER funding awards from the Energy Commission during 1998 and 1999.

- The PIER Buildings Energy Efficiency Program developed a targeted solicitation that will be released in the third quarter of 2000. Also, the Buildings program area completed the development of three contracts that received $17.32 million in PIER funding awards in 1999.

- The RD&D Committee approved a $400,000 contribution to a collaborative research project with the Gas Research Institute in the Energy-Related Environmental Research Program.

- The RD&D Committee approved a $1.4 million interagency agreement with the University of California, Irvine, to fund three projects in the PIER Environmentally-Preferred Advanced Generation Program.

- The RD&D Committee approved funding for two new projects in the PIER Industrial/Agricultural/Water Energy Efficiency Program as follows: (1) a $2 million sole source contract with the Southern California Metropolitan Water District; and (2) a $100,000 contribution towards the U.S. Department of Energy's advanced distillation project with the Electric Power Research Institute (EPRI).

- The Energy Commission approved approximately $1.63 million for two small modular biomass electricity generation projects under the PIER Renewable Energy Technology Program. The two projects were submitted in response to a competitive negotiation solicitation.

- The Energy Commission received research results for three PIER projects under the Strategic Energy Research Program that were successfully completed during this quarter.

- The Energy Commission approved 18 tailored collaborative projects with EPRI.

Further details concerning the Energy Commission's PIER Program activities for the second quarter of 2000 are provided below.

II. TRANSITION FUNDING STATUS REPORT

In 1998, the Energy Commission awarded approximately $17 million to 39 separate "transition" projects covering the six PIER program areas. Of the 39 transition projects, 37 have been completed, and one was cancelled as of the end of the fourth quarter of 1999. The one remaining transition project will be completed within the next year.

During the second quarter, written reports on the completed transition projects were being finalized. For further details on the completed transition projects, please refer to Appendix A of the *1999 Annual PIER Report.*

III. PIER PROGRAM AREA FUNDING STATUS REPORT

A. Buildings End-Use Energy Efficiency

During the second quarter of 2000, the PIER Buildings Energy Efficiency Team performed a comprehensive analysis of funding in this program area to date. The Buildings Team evaluated how well current funding is addressing the identified issues, building types, customer classes, end-uses, and other factors. Based on the results of this analysis, the Buildings Team developed a targeted solicitation that will be released in the third quarter of 2000.

In addition, the Buildings Team completed the development of three programmatic contracts awarded in the following areas:

1) Integrated Energy Systems
2) High Performance Commercial Building Systems
3) Energy Efficient and Affordable Small Commercial and Residential Buildings for a Growing California

A detailed description of these three Energy Efficiency programs is provided in the *1999 Annual PIER Report*.

B. Energy-Related Environmental Research

During the second quarter of 2000, the RD&D Committee approved a $400,000 contribution to the New York State Energy Research and Development Authority's collaborative energy research project with the Gas Research Institute. The goal of this project is to develop a more accurate and precise particulate matter (PM) reference test method for measuring PM emissions from stationary combustion sources. Other participants in this project include the U.S. Environmental Protection Agency, the U.S. Department of Energy and the California Air Resources Board.

Studies have found an association among the concentration of PM in ambient air, morbidity, and mortality. A leading hypothesis is that ultra-fine particles of particular chemical compounds are a major causative agent. Particulate emissions from gas turbines, the technology of choice for new power plants in California, may be mostly ultra-fine particles. The new reference methods developed from this collaborative research project will allow a better characterization of emissions for PM10 (particles smaller than 10 microns), PM2.5 and ultra-fine particles from combustion sources and gas turbines in particular.

C. Environmentally-Preferred Advanced Generation

During the second quarter, the University of California, Irvine, submitted an unsolicited proposal to the Environmentally–Preferred Advanced Generation Team, seeking funds for one microturbine generator and three fuel cell-related projects. In May, the RD&D Committee approved a $1.4 million interagency agreement for three of the four proposed projects. The three projects are as follows:

1) Validation of Microturbine Generator Technology
2) Fuel Cell Steady State Analysis Tools
3) Fuel Cell Hybrid Dynamic Modeling

The objective of these projects is to accelerate the successful implementation of microturbine generators and fuel cells in distributed generation applications. These technologies will reduce emissions and costs, improve power quality and reliability, conserve fuel, and expand customer choice in California. These projects are consistent with this team's Research and Development Plan and proposed funding for 1999/2000.

The Energy Commission will consider these projects for full approval at a Business Meeting during the third quarter of 2000.

D. Industrial /Agricultural/Water Energy Efficiency

During the second quarter, the Industrial/Agricultural/Water Energy Efficiency Team evaluated, and RD&D Committee approved, a $2 million sole source proposal from the Southern California Metropolitan Water District. The objective of this project is to help several Southern California water agencies use locally available water (e.g. from the Colorado River or brackish water) that is currently

unusable because of the high cost of water treatment. The development of new water treatment technologies, funded through this contract, will help overcome this barrier and, if successful, reduce the amount of energy needed to provide water supplies in Southern California. The Energy Commission will consider this project for full approval at a Business Meeting during July 2000; a contract is expected to be in place by the end of August.

In addition, the RD&D Committee approved a $100,000 contribution to the U.S. Department of Energy's advanced distillation project with EPRI. The objective of this collaboration is to develop advanced distillation technologies for petroleum refineries. Once successfully demonstrated, advanced distillation technologies can be applied to chemical, pharmaceutical, and food processing industries as well. Advanced distillation has the potential to reduce refinery energy use by 20 percent, which would result not only in cost and energy savings, but also in reduced air pollution and water conservation. The Energy Commission will consider this project for full approval at a Business Meeting during the third quarter of 2000.

E. Renewable Energy Technologies

On November 10, 1999, the Renewable Energy Technologies Program Team released a $1.3 million competitive negotiation solicitation for small-scale modular biomass power projects. The goal of this solicitation was to fund biomass-fueled distributed generation systems that will provide strategic value to California's electricity system, while simultaneously addressing environmental problems that are caused by open-field burning of agricultural residues, wildfires from forest overgrowth, and urban woodwaste landfills.

During the second quarter of 2000, the Energy Commission reviewed and approved approximately $1.63 million in funding for two small modular biomass projects. The selected projects will also receive over $4.6 million in matching funds from the U.S. Department of Energy and the private sector.

During the second quarter, the Energy Commission also approved funding for the following renewable energy technology research projects with EPRI:

- California Renewable Energy Technology Market and Benefit Assessment

  The Energy Commission approved a $340,352 co-funding agreement with EPRI that will assess the renewable energy technology markets in the Western United States (specifically focusing on California) and quantify renewable energy research and development program benefits. This research-oriented study will allow the Energy Commission to target research more effectively in order to improve the economic and public benefits of renewable energy.

  There are three primary objectives of this project. The first is the identification of the current market needs of renewable energy generation from the perspective of the developers and manufacturers of the individual technologies. The second objective is to analyze the future market trends in renewable technologies, which will provide a better understanding of how to appropriately direct PIER funds in renewable energy research. The third objective is to develop a baseline for the quantification of benefits from renewable energy generation; this baseline will set a standard for improvements in the renewable electricity marketplace that result from PIER funded research projects.

The renewable energy technologies to be addressed in this research are as follows: (a) biomass and waste fuels, (b) geothermal, (c) small (low-impact) hydro, (d) ocean or tidal current power, (e) solar photovoltaics, (f) solar thermal, (g) wind power, and (h) other renewable energy options.

- California Wind Energy Forecasting Project

The Energy Commission approved a $690,155 project with EPRI that will develop a California Wind Energy Forecasting System. This forecasting system will generate two or more daily forecasts (over a period of 48 hours) of the hourly wind generation for each wind generation area in California. The resulting forecasts will be used by the owners and operators of the various wind facilities, California electric utilities, and the California Independent System Operator, the California Power Exchange, and the Automated Power Exchange.

The overall goal of this project is to develop and commercialize a wind energy forecasting system to forecast the hourly wind generation in each of the wind areas of the State. The primary objective is to develop and test three parallel wind-forecasting systems at each of four sites over a period of one year. Project developers include Weather Services International, the Risoe National Laboratory in Denmark, and TrueWind Solutions. The secondary objective is to develop an alternate wind plant power curve at one California site, based on wind tunnel testing of a scale topographic model of the site. A developer will be selected to complete the development and commercialization of this forecasting system.

- Biomass Co-firing with Natural Gas

The Energy Commission approved a $36,958 tailored collaboration project with EPRI to identify feasible options for integrating biomass use with natural gas power systems. This project will also define the next steps to be taken, as well as identify potential partners to help carry out the next steps. One goal of this project is to improve system reliability by enabling biomass facilities to remain open in a deregulated market where they might otherwise close due to cost competition. Other goals include offering electric ratepayers cost-competitive choices for renewable “green” power by reducing the costs of biomass power, supporting economic growth by allowing current biomass plants to remain operational, and encouraging further development of the biomass industry in rural areas.

This project contributes to the PIER program objective of improving electrical system reliability by developing a method for improving the economics of grid-connected, distributed electricity generating biomass facilities.

F. Strategic Energy Research

During the second quarter of 2000, three PIER-funded projects were completed in the Strategic Energy Research program area. Descriptions of the project results are provided below.

(1) Development of a Composite Reinforced Aluminum Conductor

This $75,000, “proof of concept” PIER project was successfully completed by Goldworthy & Associates. As a result of this PIER funding, the contractor was able to develop a stronger and lighter conductor to replace aging and overloaded power lines. The conductor is a composite reinforced aluminum device that can be used to replace conventional steel reinforced aluminum wire conductors. The conductors utilize composites for mechanical support and have application to overhead transmission and distribution lines. The potential benefits of this research include an increase in transmission system capacity at a minimum increase in capital cost and improved reliability under heavy electrical loads.

(2) Electric System Seismic Safety and Reliability

This $1 million PIER-funded project was successfully completed by Pacific Gas and Electric Company in partnership with the Berkeley Pacific Earthquake Engineering Research Center. The purpose of this project was to support needed research in five major topic areas in the field of electric system seismic safety and reliability. The five topic areas include 1) Ground Motions and Site Response, 2) Rapid Estimation of Ground Shaking for Emergency Response, 3) Ground Deformation Database, 4) Electrical Substation Equipment Performance, and 5) Fire Safety Associated with Gas and Electric Systems.

The results from this PIER-funded research include the following:

- New techniques were identified to improve site and emergency response for utility emergency crews after a major earthquake.
- Development of a geologic and seismologic database that will be used to minimize the uncertainties in assessing soil structure interactions.
- Improved earthquake-related fire safety measures were identified.

The development of these technologies and protocols will improve the reliability of California's electricity system by reducing the vulnerability of electric systems to damage caused by earthquakes.

(3) Secondary Distribution Impacts of Residential Electric Vehicle (EV) Charging

This $100,000 PIER-funded project was a collaborative funding effort with Georgia Technology Research Corporation, which provided $95,000 in matching funds. The purpose of this project was to analyze the power quality impacts of large single-phase residential loads, such as electric vehicle chargers. The market penetration of these large single-phase residential loads is a concern to distribution utilities, electric power providers, and consumers. Charging systems with high harmonic current distortion can result in secondary distribution line de-rating or losses, resulting in economic and quality of service consequences. These losses also have an economic penalty to consumers because they ultimately increase the cost of electricity to the user.

The main conclusions of this project (based upon the utility systems and chargers investigated) are as follows:

- Commercial light-duty EV chargers engineered to National Electric Vehicle Infrastructure Working Council (IWC) guidelines do not give rise to excessive voltage on the secondary side of the transformer.
- The rise in voltage total harmonic distortion (THD) due to EV charging was found to be within .8 percent in all three field test sites and should not be cause for concern.
- The influence of EV charging on transformer temperature at one field site showed that a rise in temperature was not attributable to voltage THD; rather, transformer temperature was affected by the extra loading on the transformer from the EV.
- The main cause for concern is the overloading of the distribution transformer with the widespread use of EV chargers (assuming the chargers meet voluntary IWC guidelines so that voltage THD is not an issue).

The results of this project have received national attention. They were presented and published at the North American Electric Vehicle Infrastructure Conference in November 1999. A final report will be presented at the Electric Vehicle Symposium in October 2000. The results have also been provided to the Institute of Electrical and Electronic Engineers Task Force on Single Phase Harmonics and a summary will be provided to EPRI for release to the IWC.

IV. PIER COLLABORATIVE RESEARCH FUNDING STATUS REPORT

In 1998, the Energy Commission approved a one-year, $1.5 million partnership with EPRI focused on funding collaborative research in seven key areas for California. In 1999, the Energy Commission augmented the funding with $11.7 million to include twenty additional research areas. As a result, this partnership has been extended through 2000.

This collaborative funding allows the Energy Commission to participate in guiding national RD&D activities in specified areas and will help to ensure that California continues to receive the benefits of these nationally funded RD&D efforts. In addition, the State of California is able to leverage up to thirteen dollars for every one dollar of PIER Program funding. Through this collaborative funding effort, the PIER Program supports California-specific electricity-related research in 27 target areas.

As of March 31, 2000, work authorizations for 18 tailored collaboration agreements were put into place, and the projects were initiated in the six PIER program areas. (Examples of some of these projects are provided in Section III of this report).

V. PIER ENERGY INNOVATIONS SMALL GRANTS FUNDING STATUS REPORT

The PIER Energy Innovations Small Grants program, administered by the California State University Institute, provides a simplified funding-award process for innovative, "proof of concept" research projects proposed by small businesses, non-profits, academic institutions and individuals. The maximum amount of any individual grant award is $75,000.

During the second quarter of 2000, the Energy Commission approved a $5 million contract with the California State University Institute to continue this program through September of 2002.

Through the Energy Innovations Small Grants Program, the Energy Commission has released six solicitations to date. For the first four solicitations, the Energy Commission has approved 39 projects totaling $2.8 million. These projects started in October 1999.

The fifth-round proposals were due on April 28, 2000, and resulted in 25 new grant applications. Scoring was completed during the week of July 10, 2000. Round six was released in June; proposals are due on July 28, 2000.

VI. OTHER PIER PROGRAM ACTIVITIES

A. Information Transfer/Reporting Activities

During the second quarter of 2000, the Energy Commission continued a collaborative effort with Science Applications International Corporation (SAIC) to redesign the PIER Program Web Site. The staff continues to provide program information to SAIC for input into the new Web Site. Although this project was not completed during the second quarter as originally planned, it is expected to be finalized within the next few months.

B. Independent Review Panel for PIER Evaluation

PRC Section 25620.9(a) required the Energy Commission to designate an independent panel of experts by January 1, 1999, to conduct a comprehensive evaluation of the PIER Program. PRC Section 25620.9(b) required the Independent Review Panel to submit a preliminary report of its findings to the Legislature by March 31, 2000. The Panel met this requirement and submitted its preliminary report during the first quarter of 2000.

The Panel found that the PIER Program has realized many important accomplishments over the last two years. The Panel also found that some areas of the PIER Program had problems that hindered effective program execution. Overall, the Panel's evaluation provides important guidance on how to improve the PIER Program.

During the second quarter of 2000, Energy Commissioner Robert Laurie met with the Independent Review Panel's Chair (Dr. John S. Foster) to discuss a strategy that calls for the PIER Program and the Panel to work together in the coming year to address each of the issues raised by the Panel. In addition, the Panel met on April 24th and 25th to develop its work agenda for the final report, due to the Legislature by March 31, 2001. The Panel decided to form committees to review each of the PIER Program Area projects. The results of this project-by-project review will be included in the Panel's final report.

VII. CONCLUSION

The Energy Commission remains fully committed to administering the PIER Program in an efficient and effective manner that ensures public input and accountability. The PIER section of the Energy

Commission's Web Site is a means of communicating with stakeholders and the public. The Web Site can be accessed at:

<www.energy.ca.gov/research/PIER/index.html>
